

### Remarks

In view of the following remarks and amendments, favorable reconsideration of the outstanding office action is respectfully requested. Claims 1 – 55 remain in this application.

#### **1. Allowed Claims/Subject Matter**

Applicant notes with appreciation that the Examiner has indicated the subject matter of claims 15 – 23, and 44 is patentable, and would be allowable if rewritten in independent form.

#### **2. § 102 Rejections**

The Examiner has rejected claims 1 – 3 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,351,011 to Liberman. The Applicants respectfully traverse the rejection because the Examiner has failed to make a prima facie case of anticipation, since he has failed to show where each element can be found in the cited reference.

Claim 1 is directed to an arc fault detector for a power line system. The arc fault detector includes an upstream/downstream discriminator circuit. The discriminator circuit detects current fluctuations in at least one current characteristic of a load current and voltage fluctuations in at least one voltage characteristic of a line voltage. The discriminator circuit detects an upstream transient event when the current fluctuations and the voltage fluctuations are in phase. The discriminator circuit detects a downstream transient event when the current fluctuations and the voltage fluctuations are out of phase.

Liberman is directed to a directional wave detector apparatus for electrical power line relay protection devices that is configured to determine the direction of a fault. The current and voltage of the traveling waves generated by a fault point are combined at a measuring point and the sign of the combined signal is determined. A tripping or blocking signal is emitted depending on whether the sign of the combined signal indicates that the fault lies within or outside the range protection of the relay protection device.

According to **MPEP 2131**, “to anticipate a claim, the reference must teach every element of the claim.” A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

The Applicants point out that the Examiner has failed to show where Liberman discloses an arc-fault detector that includes an upstream/downstream discriminator circuit, as recited in claim 1.

The Examiner asserts that Liberman discloses an upstream/downstream discriminator circuit which detects load current fluctuations and line voltage fluctuations (column 2, lines 16 – 23). The Examiner relies on column 2, lines 16 – 23 for support for his assertion. However, column 2, lines 16 – 23 merely states that each detector includes a current input and a voltage input. However, Liberman does not detect voltage or current fluctuations separately. Turning to column 1, lines 51 – 55, Liberman states: “Instead of treating voltage and current waves individually, the product of voltage and current is formed, that is, the power or its integral, energy.” As anyone of ordinary skill in the art knows,  $P = I \cdot V$ , i.e., power is the product of current times the voltage. The Applicants respectfully point to Figures 1a, 1b, 2a, and 2b, and point out that in each case, Liberman multiplies the current by the voltage before detection. Thus, Liberman does not disclose a discriminator circuit that detects current fluctuations in at least one current characteristic of a load current and voltage fluctuations in at least one voltage characteristic of a line voltage, as recited in claim 1.

The Examiner asserts that Liberman’s detector “detects an upstream even when fluctuations are in phase and detects a downstream transient event when fluctuations are out of phase.” The Examiner relies on column 3, lines 4 – 36, 50 – 55, and column 4, lines 1 – 2. However, Figure 2a of Liberman, discussed in column 3, lines 4 – 36, shows that the current signal and the voltage signal are individually integrated and then multiplied together. Thus, one input to summation device 13 is the current integral multiplied by the integrated voltage. The other input is a time delayed version of the integrated current multiplied by the integrated voltage. The multiplied integral value is compared with the time-delayed multiplied integral value. Thus, column 3, lines 4 – 36 does not disclose a discriminator circuit that detects an upstream transient event when the current fluctuations and the voltage fluctuations are in phase, or a discriminator circuit that detects a downstream transient event when the current fluctuations and the voltage fluctuations are out of phase, as recited by claim 1.

Figure 2b shows a system wherein one leg multiplies current and voltage (5) and the other leg multiplies a time delayed voltage and a time delayed current. Both multiplications obtain a power measurement, one being a time delayed version of the other. Each of these power measurements are integrated to obtain energy measurements. The energy measurements are summed and compared. Thus, column 3, lines 37 – 50 does not disclose a

discriminator circuit that detects an upstream transient event when the current fluctuations and the voltage fluctuations are in phase, or a discriminator circuit that detects a downstream transient event when the current fluctuations and the voltage fluctuations are out of phase, as recited by claim 1. Column 3, line 50 – column 4, line 2 states that different signs of current and voltage may be compared to determine the direction of the fault. However, it does not disclose a discriminator circuit that detects an upstream transient event when the current fluctuations and the voltage fluctuations are in phase, or a discriminator circuit that detects a downstream transient event when the current fluctuations and the voltage fluctuations are out of phase, as recited by claim 1.

Accordingly, the Examiner has failed to make a prima facie case of anticipation because the Examiner has not shown where Liberman disclose every element of claim 1. Claim 2 and claim 3 are patentable in their own right, and also by virtue of their dependency from claim 1. As such, the Applicants respectfully assert that claims 1 – 10, and 46 – 55 are patentable under 35 U.S.C. § 102(b), and request that the rejection of claims 1 – 3 under 35 U.S.C. § 102(b) be withdrawn.

### **3. § 103 Rejections**

The Examiner has rejected claims 5, 8 – 13, 31, 32, 34 – 37, 41 – 43, 46 – 48, 50, 53 – 55 under 35 U.S.C. § 103 as being unpatentable for obviousness over Liberman in view of U.S. Patent No. 4,922,368 to Johns.

Claim 11 is directed to an arc fault protection device that is protective of a branch circuit portion of a power line electrical distribution system and connected to a load. The arc fault protection device includes a first sensor for detecting current fluctuations in at least one current characteristic of load current. The device also includes a second sensor for detecting voltage fluctuations in at least one voltage characteristic of a line voltage. A discriminator for comparing the polarities of the voltage fluctuations and the current fluctuations is also included. The comparison indicates whether an arc fault or arc mimicking noise is located in the branch circuit portion or located in a remainder of the electrical distribution system based on the comparison of the polarities.

Claim 41 is directed to an arc fault protection device that is protective of a branch circuit portion of a power line electrical distribution system and connected to a load. The arc fault protection device includes means for detecting current fluctuations in at least one current characteristic of a load current. The device also includes means for detecting voltage

fluctuations in at least one voltage characteristic of a line voltage. Means for comparing the polarities of the voltage fluctuations and the current fluctuations is also included. The comparison indicates whether an arc fault or arc mimicking noise is located in the branch circuit portion or located in a remainder of the electrical distribution system based on the comparison of the polarities.

Claim 42 is directed to a method for protecting a branch circuit portion of an electrical distribution system from an arc fault, the branch circuit portion is connected to a load. The method includes the steps of: detecting current fluctuations in at least one current characteristic of load current; detecting voltage fluctuations in at least one voltage characteristic of a line voltage; and comparing the polarities of the voltage fluctuations and the current fluctuations. The comparison indicates whether an arc fault or arc mimicking noise is located in the branch circuit portion or located in a remainder of the electrical distribution system based on the comparison of the polarities.

Liberman was discussed above.

Johns is directed to discriminating circuits that are coupled to receive signals from a protected transmission circuit. Each discriminating circuit also receives from a direction detector, signals that indicate a fault occurs either forward or behind a predetermined point. The discriminating circuit is arranged to produce an output signal to trip a circuit breaker of the protected circuit only if a fault occurs within the protected circuit. In this respect, the discriminating circuit only outputs a trip signal if it receives within the same time period both a signal from the direction detector indicating that the fault is appropriately located, and high frequency signals from the protected circuit, since high frequency noise is invariably generated when faults arise in transmission circuits.

According to the **MPEP 2143**, three basic criteria must be met to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaack*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

**A. The prior art references do not teach or suggest all the claim limitations.**

Regarding claims 11, 41, and 42, the Examiner asserts that “Liberman does not disclose indicating whether an arc fault is located in a branch circuit portion or located in the remainder of an electrical distribution system.” While the Applicants agree with the Examiner’s statement, the Examiner never states what Liberman does teach or suggest with respect to claim 11, claim 41, or claim 42.

The Examiner asserts that “Johns discloses a discriminator for comparing voltage and current fluctuations (column 6, lines 27 – 42) for indicating whether an arc fault (column 4, line 65 – column 5, line 13) is located in a branch circuit portion or located in the remainder of an electrical distribution system (column 12, lines 17 – 43).

The text at column 6, lines 27 – 42 states:

“It will be seen that the circuit of FIG. 2 comprises a parallel arrangement of a capacitor C2, an inductor L2 and a switch S connected to the stack tuning capacitor Cc by way of a further inductor L1. A resistance RL shown in series with the inductor L1 represents the losses in the tuned circuit and is typically less than 50Ω. The parallel connection of the capacitor C2, the inductor L2, and the switch S is connected to ground by way of a small resistance R arranged to provide an output voltage V0, when the switch S is closed, which is proportional to any current within the frequency range of interest shunted to ground. Similarly, when the switch S is open, the output voltage V0 is proportional to the voltage developed across the inductor L2 and the resistance R by signals within the frequency range of interest.

The text at column 4, line 65 – column 5, line 13 states:

The switches Ss and Sr are hypothetical switches, being implemented, as will be described below, by tuned circuits which also act as detector means to detect the existence of signals in the protected line having a frequency within a predetermined frequency band. The switches Ss and Sr are arranged to present either a short circuit or an open circuit to any signals having a frequency within the predetermined frequency band. In this respect, it has been discovered that whatever the fault which arises on high voltage power lines, there is always arcing and/or discharging caused which induces high frequency noise. Generally, the noise signals produced by faults are wideband, but the switches Ss and Sr are generally arranged to present the short circuit or an open circuit to a relatively narrow band of high frequencies.

Finally, the text at column 12, lines 17 – 43 states:

“Let us consider the operation of the system of FIG. 10 ....Firstly, consider the operation if a fault F.sub.2 occurs which is external to the two protected lines 102 directly connected to the locating circuit DL2. When the fault F2 occurs, high frequency signals are impressed on the line at that point. These signals arrive at the locating circuit DL3 and output signals Vox3 and Voy3 are applied to the discriminator circuit DDD3. We will see later, that in this situation, the discriminator circuit DDD3 will output a trip signal Tf. The high frequency signals arriving

at the locating circuit DL3 are fed towards the locating circuit DL2 but are attenuated by the line trap circuit 140. For example, the level of the in-band signals at terminal X.3 with the particular circuit parameters suggested will be approximately (1/21)th of the original signal level at terminal Y3. The level of the in-band signals arriving at the locating circuit DL2 is therefore relatively low and the respective discriminator circuit DDD2 is arranged not to output trip signals in response to such low level signals .

If an internal fault F1 occurs, the whole of the high frequency signal arrives at both the locating circuits DL2 and DL3 and their discriminators DDD2 and DDD3 are arranged to output trip signals. However, these signals are attenuated by the line trap circuits 140 of the two locating circuits DL2 and DL3 such that only low level high frequency signals are received elsewhere along the line.”

First, the Applicants note that the Examiner mixes and matches excerpts from Johns to make the rejection. The first citation is directed to Figure 1, the second is directed to Figure 2, and the third citation is directed to Figure 3. Second, none of the cited portions of text taken from Johns teaches or suggests “a discriminator for comparing voltage and current fluctuations for indicating whether an arc fault is located in a branch circuit portion or located in the remainder of an electrical distribution system” as asserted by the Examiner.

Claim 11:

In light of the above discussion of the text cited from Johns, the Examiner fails to identify the arc fault protection device, the branch circuit, or the load. Thus, the Examiner fails to point out where Johns or Liberman, whether taken alone or in combination, teach or suggest an arc fault protection device that is protective of a branch circuit portion of a power line electrical distribution system, the branch circuit being connected to a load, as recited in claim 11.

The cited text provided above does not discuss current fluctuations or means for detecting such. Therefore, the Examiner has failed to point out where Johns or Liberman, whether taken alone or in combination, teach or suggest means for detecting current fluctuations in at least one current characteristic of a load current, as recited in claim 11.

While Johns does discuss detecting high voltage signals in a particular frequency band, Johns does not include any mention of comparing voltage signals with current signals. Thus, the Examiner has failed to point out where Johns or Liberman, whether taken alone or in combination, teach or suggest means for comparing the polarities of the voltage fluctuations and the current fluctuations is also included, as recited in claim 11.

Accordingly, claim 11 is patentable under 35 U.S.C. § 103 because the neither Liberman nor Johns, whether taken alone or in combination, teach or suggest all of the claim

elements of claim 11. Claims 12 – 40 and 43 – 45 are patentable in their own right and also by virtue of their dependency from claim 11. The Applicants respectfully request that rejection of claims 11 – 40 and 43 – 45 under 35 U.S.C. § 103 be withdrawn.

Claim 41 and Claim 42:

These claims are directed to an apparatus and method for protecting a branch circuit portion of an electrical distribution system from an arc fault, wherein the branch circuit portion is connected to a load. As noted above in the discussion of claim 11, the Examiner has failed to point out where Johns or Liberman, whether taken alone or in combination, teach or suggest a device for protecting a branch circuit portion of a power line electrical distribution system that is connected to a load. Claim 41 is also directed to a device for protecting a branch circuit portion of an electrical distribution system from an arc fault, whereas claim 42 is directed to a method for doing the same.

As noted above, the Examiner has failed to point out where Johns or Liberman, whether taken alone or in combination, teach or suggest means for detecting current fluctuations in at least one current characteristic of a load current. Thus, neither Johns nor Liberman, whether taken alone or in combination, can possibly teach or suggest detecting current fluctuations in at least one current characteristic of load current, and comparing the polarities of detected voltage fluctuations to the detected current fluctuations, as recited in claim 41 and claim 42.

The Applicants respectfully request that rejection of claims 41 and 42 under 35 U.S.C. § 103 be withdrawn because the Examiner has failed to point out where the prior art references teach or suggest all the claim limitations.

**B. There is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine reference teachings.**

According to MPEP 2143.01, if a proposed combination of the prior art would change the principle of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 123 USPQ 349 (CCPA 1959). In this case, Liberman discloses a directional wave apparatus that detects the direction of a fault by monitoring power or energy (See column 1, lines 51 – 55). Johns, on the other hand, detects faults in a transmission circuit by measuring voltage characteristics (Figure 5 –

7, and 14). Thus, one of ordinary skill in the art would not be motivated to combine Johns with Liberman because Johns apparatus is not configured to detect measured power, and Liberman's apparatus would have to be changed from detecting the characteristics of the circuit's power or energy to detecting the characteristics of the circuit's voltage characteristics. Therefore, the proposed combination of the prior art would change the principle of the prior art invention being modified, i.e., Liberman. Ergo, the teachings of the references are not sufficient to render the claims *prima facie* obvious.

### **C. Dependent claims**

The Examiner has rejected claim 4 under 35 U.S.C. § 103 as being unpatentable for obviousness over Liberman in view of U.S. Patent No. 4,538,520 to McBride. The Examiner has failed to point out where McBride teaches or suggests the elements missing from claim 1. Claim 4 depends from claim 1. The Applicants respectfully request that rejection of claim 4 under 35 U.S.C. § 103 be withdrawn because the Examiner has failed to point out where the prior art references teach or suggest all the claim limitations recited therein.

The Examiner has rejected claim 6 and 7 under 35 U.S.C. § 103 as being unpatentable for obviousness over Liberman in view of U.S. Patent No. 4,434,509 to Blades. The Examiner has failed to point out where Blades teaches or suggests the elements missing from claim 1. Claims 6 and 7 ultimately depend from claim 1. The Applicants respectfully request that rejection of claim 6 and claim 7 under 35 U.S.C. § 103 be withdrawn because the Examiner has failed to point out where the prior art references teach or suggest all the claim limitations recited therein.

The Examiner has rejected claims 24 – 30, 33, 38 – 40, 45, 51, and 52 under 35 U.S.C. § 103 as being unpatentable for obviousness over Liberman in view Johns and further in view of Blades. The Examiner has failed to point out where either Johns or Blades, whether taken alone or in combination, teach or suggest the elements missing from claim 1 or claim 11. Claims 51 and 52 depend from claim 1, whereas claims 24 – 30, 33, 38 – 40, and 45 depend from claim 11. The Applicants respectfully request that rejection of claims 24 – 30, 33, 38 – 40, 45, 51, and 52 under 35 U.S.C. § 103 be withdrawn because the Examiner has failed to point out where the prior art references teach or suggest all the claim limitations recited therein.

The Examiner has rejected claim 14 under 35 U.S.C. § 103 as being unpatentable for obviousness over Liberman in view Johns and further in view of U.S. Patent No. 5,572,138 to



Nimmersj”o. Claim 14 depends from claim 11. The Examiner has failed to show where Nimmersj”o includes the limitations not taught by the combination of Liberman and Johns. The Applicants respectfully request that rejection of claim 14 be withdrawn because the Examiner has failed to point out where the prior art references teach or suggest all the claim limitations recited therein.

The Examiner has rejected claim 49 under 35 U.S.C. § 103 as being unpatentable for obviousness over Liberman in view Johns and further in view of McBride. Claim 49 depends from claim 1. The Examiner has failed to show where either McBride or Johns include the limitations of claim 1 that are missing from Liberman. The Applicants respectfully request that rejection of claim 49 be withdrawn because the Examiner has failed to point out where the prior art references teach or suggest all the claim limitations recited therein.

#### **D. No Prima Facie Case of Obviousness**

The Applicants respectfully request that the rejection of claims 4 – 55 under 35 U.S.C. § 103 be withdrawn because the Examiner has failed to make a prima facie case of obviousness since he has failed to point out where the combined references teach or suggest all of the claim limitations and because the references cannot be properly combined.

#### 4. Conclusion

Based upon the remarks and papers of record, Applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests reconsideration of the pending claims 1 – 55 and a prompt Notice of Allowance thereon.

Applicant believes that no extension of time is necessary to make this Response timely. Should Applicant be in error, Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Response timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 50-0289.

Please direct any questions or comments to Daniel P. Malley at (607) 256-7307.

Respectfully submitted,

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